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THE WESTERN WAY

Conservative Stewards of the Western Environment

May 17, 2019

Arizona Corporation Commission
1200 W. Washington Street
Phoenix, AZ 85007-2996

RE: ACC DOCKET no. RU-00000A-18-0284

Dear Chairman Burns and Arizona Corporation Commissioners:

Thank you for the opportunity to comment on the Possible Modifications to the Arizona Corporation Commission's (Commission) Energy Rules. Rapid technological advancements, lower levelized costs, and consumer demands are driving changes to state energy policies across the country, and we appreciate that the Commission is moving forward with an open discussion on Arizona's energy policy.

The Western Way, an organization committed to free-market solutions to address environmental challenges, believes that the ACC should adopt a comprehensive energy plan with a balanced energy portfolio that can control costs, save ratepayers money, manage demand, reduce waste, create Arizona jobs, without over the top mandates.

A clear and well thought out energy plan for the 21st century will unlock economic development possibilities across the state of Arizona, especially in rural parts of the state that are eager for investment and growth. Earlier this year, The Western Way in partnership with the Yuma County Chamber of Commerce, released an economic impact study looking at the benefits of renewable energy facilities in rural Arizona. A full copy of the report is attached.

Over a year ago, The Western Way offered support for Commissioner Tobin's Energy Modernization proposal because it was an innovative vision that embraced a strong goal for clean energy, invested in energy efficiency, and prioritized innovations from in-state solar and storage that would save rate payers money. While the ACC has been discussing state energy policy changes, utilities, driven by market innovations, have been busy making major announcements regarding new facilities and goals. APS's announcement to build 850 MW of storage is a huge step towards a clean and modern power grid that Arizonan's want. The ACC needs to move forward with this discussion and provide smart public policies so utilities and ratepayers will have a proper framework and certainty to plan for the future.

Sincerely,

Jaime A. Molera
Arizona State Director, The Western Way

The Economic Benefits of Arizona Rural Renewable Energy Facilities

March 2019

Prepared for:

THE WESTERN WAY

Conservative Stewards of the Western Environment

Yuma County Chamber of Commerce Since 1905

Prepared By:

Development Research Partners

Development Research Partners specializes in economic research and analysis for local and state government and private sector businesses. Founded in 1994, Development Research Partners combines extensive experience in real estate economics and economic development to provide clients with insightful and strategic consulting services in four areas of expertise:

- **Economic and Demographic Research**

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SUMMARY

Economic and Fiscal Benefits of Rural Renewable Energy Facilities in Arizona

- From 2001 to 2017, the total direct and indirect benefits of rural renewable energy development activity in Arizona was an estimated $9.4 billion in total output ($4.6 billion direct output + $4.7 billion indirect and induced output) produced by 17,971 employees (9,054 direct employees + 8,917 indirect employees) earning a total of about $1.2 billion ($717.2 million direct earnings + $477 million indirect earnings).

  The benefits included a direct fiscal benefit to Arizona of an estimated $16.7 million in transaction privilege and use tax revenue.

- In 2018, the total direct and indirect benefits of annual rural renewable energy operations in Arizona will be an estimated $63.3 million in total output ($39.5 million direct output + $23.8 million indirect and induced output) produced by 702 employees (234 direct employees + 468 indirect employees) earning a total of about $33.5 million ($15.1 million direct earnings + $18.4 million indirect earnings).

  The benefits will include a direct fiscal benefit to schools in Arizona of an estimated $882,000 in property tax revenue.

Case Study of the Potential Economic and Fiscal Benefits of a new 100 MW-Solar Photovoltaic Energy Facility with 30 MW of Battery Storage in Yuma County

- The total direct and indirect benefits of construction activity associated with a 100 MW-solar PV energy facility with 30 MW of battery storage in Yuma County could be an estimated $9.1 million in total output ($4.4 million direct output + $4.7 million indirect and induced output) produced by 22 employees (12 direct employees + 10 indirect employees) earning a total of about $1.3 million ($798,400 direct earnings + $510,000 indirect earnings) during the construction period.

- The total direct and indirect benefits of annual operations for a new 100 MW-solar PV energy facility with 30 MW of battery storage in Yuma County could be an estimated $3 million in total output ($1.9 million direct output + $1.1 million indirect and induced output) produced by 30 employees (9 direct employees + 21 indirect employees) earning a total of about $1.5 million ($689,000 direct earnings + $842,000 indirect earnings).

  The benefits will include an annual direct fiscal benefit to Yuma County of an estimated $165,700 in property tax revenue.

  In addition to the direct county benefit, there will also be a benefit to local schools and other property tax districts in the county. Based on average primary and secondary rates in the county, local property tax districts will benefit from $677,500 in annual property tax revenue.

INTRODUCTION

Renewable energy generation facilities are growing in importance to communities across Arizona, including those in rural areas of the state. Renewable energy capacity is expanding in Arizona, particularly from non-hydroelectric renewable sources such as solar and wind. Since 2000, net electricity generation from non-hydroelectric sources increased from close to 0 percent of total net generation to 4.2 percent in 2016.[1] Renewable energy generation in Arizona is expected to continue to grow as Arizona has implemented policies to encourage renewable development. The state has a renewable portfolio standard that requires electric utilities to generate 15 percent of their energy from renewable resources by 2025. The state also has a variety of renewable energy tax incentives. Additionally, the rapidly falling cost of renewable energy technologies has also enhanced their viability. For instance, the average unsubsidized levelized cost of utility-scale crystalline solar photovoltaic facilities in the United States has decreased about 86 percent since 2009.[2] In many cases, the cost of utility-scale solar PV and wind technologies has fallen below plants utilizing traditional energy sources including natural gas combined cycle and peaking power plants. The intent of this study is to estimate the economic and fiscal benefits to Arizona of the construction and operations of utility-scale[3] solar and wind generation facilities that are located in rural areas of the state. In addition to a statewide analysis, this study includes a case study estimating the potential benefits a renewable facility could have in a rural county, demonstrating the potential benefits that can be realized in similar communities throughout the state.

ECONOMIC AND FISCAL IMPACT ANALYSIS DEFINED

Economic impact analysis is the analytical approach used to assess measurable direct and indirect benefits resulting from a project over a specific time period. Only those benefits that can be measured or quantified are included. Intangible benefits, such as enhancement of community character or diversification of the job base, are not included. The economic benefits are calculated within the framework of two categories of impacts and activities, which are construction and on-going operations.

Further, the economic impact is divided into direct and indirect impacts. The direct impacts include the direct spending for construction of a renewable facility and the direct spending for the on-going operations of the facility, including employee spending. The impact of constructing utility-scale renewable energy facilities has large but temporary impacts on the affected communities during the construction period. The construction impacts include the purchase of construction materials, construction worker earnings and resulting expenditures, and the tax implications of these purchases. The impact of on-going operations and maintenance of utility-scale renewable energy facilities has an annual impact on the affected communities over the life of the project. The on-going operations impacts include annual purchases of operational materials, replacement capital purchases, land-owner payments, employment and earnings, and the tax implications of these annual expenditures. The direct economic benefits of the facilities were estimated using the Jobs and Economic Development Impacts (JEDI) models developed by the National Renewable Energy Laboratory (NREL).

The economic impact does not stop with the direct impacts as the spending patterns associated with the renewable energy facility and its employees has multiplicative impacts on the region. Therefore, multiplier analysis

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[1] Energy Information Administration, State Energy Data System.

[2] Unsubsidized levelized cost of energy quantifies the net present value of the cost of a facility over its lifetime including initial capital investment and on-going operations. Reference Lazard's Levelized Cost of Energy Analysis – Version 11.0. https://www.lazard.com/media/450337/lazard-levelized-cost-of-energy-version-110.pdf.

[3] According to the Office of Energy Efficiency & Renewable Energy in the U.S. Department of Energy, and for the purposes of this study, utility-scale renewable energy projects are defined as those 10 megawatts or larger. Utility-scale projects are generally associated with regulated electric utilities and independent power producers whose primary industry is electric power generation, transmission, and distribution.

is used to trace the impacts on businesses, organizations, and individuals affected by the facility as this impact works its way through the economy. The indirect and induced jobs and income flows generated are estimated using the RIMS (Regional Input-Output Modeling System) II multipliers developed by the Bureau of Economic Analysis of the U.S. Department of Commerce. This is the standard methodology for conducting multiplier analysis. The total economic benefits will be discussed in terms of the direct and indirect values of gross output, payroll or earnings, and employment in the specified region.

Fiscal impact analysis is used to assess the direct public revenues and public costs resulting from a project over a specific time period. A project may generate a broad array of public revenues ranging from sales/use tax, property tax, franchise fees, licenses and permits, and other charges for services. In turn, the local government provides a variety of public services such as police protection, public works, community social and recreational programs, and community development services, to name a few. This report includes a limited fiscal impact analysis, including estimates of direct sales/use tax revenue and property tax revenue generated only.

Development Research Partners utilized several sources of data for this study including company announcements, the State of Arizona, Lazard, the National Renewable Energy Laboratory, the U.S. Census Bureau, the U.S. Bureau of Labor Statistics, and the Energy Information Administration. Development Research Partners made every attempt to collect the necessary information and believe the information used in this report is from sources deemed reliable but is not guaranteed.

Some numbers in the study may not add exactly due to rounding, this analysis estimates the economic and fiscal benefits in nominal dollars.

CONSTRUCTION AND INVESTMENT ACTIVITY, 2001-2017

Since 2001, there have been 34 utility-scale solar and wind energy facilities with a total nameplate capacity of 2,087.3 megawatts (MW) installed in rural areas[4] of Arizona. Nearly half of the installed capacity, about 47 percent in 12 projects, is located in rural areas of Maricopa County. Arizona is a prime location for solar energy with 30 projects and about 87 percent of the installed capacity, or 1,820 MW, in either photovoltaic or solar thermal facilities. Wind energy comprises a smaller amount of installed capacity with 267.3 MW in four facilities. Most of the existing renewable facilities in rural areas of Arizona were built after 2011. Indeed, about 72 percent of the existing facilities and 87 percent of nameplate capacity was built from 2012 to 2017. Only the first phase of one of rural Arizona's existing facilities was built prior to 2009, the Springerville solar PV plant, which started operating in 2001.

Table 1: Rural Arizona Renewable Energy Facilities

Plant Name	County*	Technology	Operating Year	Nameplate Capacity (MW)
Agua Caliente Solar Project	Yuma	Solar Photovoltaic	2012 & 2014	347.7
Apache Solar 1	Cochise	Solar Photovoltaic	2017	90.0
Arlington Valley Solar Energy II	Maricopa	Solar Photovoltaic	2013	129.0
Bonnybrooke PV	Pinal	Solar Photovoltaic	2016	50.0
Chino Solar Valley	Yavapai	Solar Photovoltaic	2012	19.0
Copper Crossing Solar LLC	Gila	Solar Photovoltaic	2011	20.0
Cotton Center Solar	Maricopa	Solar Photovoltaic	2011	17.0
Dry Lake Wind LLC	Navajo	Wind	2009	63.0
Dry Lake Wind II LLC	Navajo	Wind	2010	65.1
Foothills Solar Plant	Yuma	Solar Photovoltaic	2013	35.0
Fort Huachuca Solar PV Project	Cochise	Solar Photovoltaic	2014 & 2017	17.7
Gila Bend	Maricopa	Solar Photovoltaic	2014	32.0
Gillespie 1	Maricopa	Solar Photovoltaic	2013	15.0
Hyder Solar	Yuma	Solar Photovoltaic	2011-2012	22.0
Hyder II	Yuma	Solar Photovoltaic	2013	14.0
Kayenta Solar Project	Navajo	Solar Photovoltaic	2017	27.3
Kingman 1	Mohave	Solar PV & Wind	2011	10.5
Mesquite Solar 1	Maricopa	Solar Photovoltaic	2011-2012	170.0
Mesquite Solar 2, LLC	Maricopa	Solar Photovoltaic	2016	100.0
Mesquite Solar 3, LLC	Maricopa	Solar Photovoltaic	2016	150.0
Mohave Electric at Fort Mohave	Mohave	Solar Photovoltaic	2015-2016	14.4
Paloma Solar	Maricopa	Solar Photovoltaic	2011	17.6
Perrin Ranch Wind LLC	Coconino	Wind	2012	99.2
Prescott Solar Plant	Yavapai	Solar Photovoltaic	2011	10.8
RE Bagdad Solar I LLC	Yavapai	Solar Photovoltaic	2011	16.6
Red Horse 2	Cochise	Solar PV & Wind	2015	81.0
Red Horse III	Cochise	Solar Photovoltaic	2016	30.0
Red Rock	Maricopa	Solar Photovoltaic	2017	40.0
Saddle Mountain Solar I	Maricopa	Solar Photovoltaic	2012	15.0
Sandstone Solar	Pinal	Solar Photovoltaic	2015	45.0
Solana Generating Station	Maricopa	Solar Thermal	2013	280.0
Springerville	Apache	Solar Photovoltaic	2001, 2010, & 2014	13.4
SR85	Maricopa	Solar Photovoltaic	2015	10.0
Sulphur Springs	Cochise	Solar Photovoltaic	2016	20.0
Total				2,087.3

Source: U.S. Department of Energy, Energy Information Administration.

**Only includes facilities in rural areas in each county. For example, plants located in rural areas of Maricopa County.*

[4] The rural facilities in this analysis were identified with input from The Western Way and do not necessarily align with rural areas as defined by population or other factors.

The renewable energy development in rural Arizona brought significant investment to the state. From 2001 to 2017, there has been an estimated $8 billion in construction and investment in renewable energy facilities in rural Arizona. Construction and investment activities benefit the state as developers and contractors hire labor, purchase construction materials and equipment, and invest in infrastructure.

Table 2: Rural Renewable Energy Facility Construction Activity in Arizona, 2001 to 2017

	Total
Construction Activity ($ in millions)	
Major Equipment	$3,228.7
Construction Materials	$1,271.5
Design, Engineering, Planning, Other Costs	$2,740.8
Wages and Salaries	$546.7
Employee Benefits	$234.3
Total	**$8,022.0**
Construction Employees (FTE)	8,425

Direct Economic and Fiscal Benefits

- A large amount of the costs associated with renewable energy facilities is for energy generating equipment such as solar modules, mirrors, heat collection elements and exchangers, turbines, and generators. Based on estimates derived from NREL's JEDI models, and adjusting for cost reductions when necessary, an estimated $3.2 billion was spent on purchases of major generating equipment (Table 2). While most of the equipment was manufactured by companies located outside of the state, Arizona has solar manufacturing facilities and has benefited from a portion of these purchases. The direct economic benefit in Arizona from purchases of major generating equipment in the state for rural renewable energy facilities was an estimated $348.3 million from 2001 to 2017 (Table 3).
- Although many purchases of renewable energy generating equipment are made out-of-state, the state has benefited from a large percentage of the construction materials purchases, design, project management, planning, and other costs. Many materials for site preparation and construction are purchased locally. Based on state spending estimates in the JEDI models, the direct economic benefit to Arizona from 2001 to 2017 for purchases of construction materials, design, engineering, planning, and other costs was $3.6 billion (Table 3).
- An estimated 8,425 full-time equivalent construction workers,[5] earning $781 million in wages and employee benefits were employed at the 34 renewable energy facilities constructed from 2001 to 2017 (Table 2). Based on estimates of local labor from the JEDI model and state wage levels, the direct economic benefit to Arizona for rural renewable energy projects was an estimated $625.1 million in earnings[6] for 8,335 workers (Table 3).
- In Arizona, income derived from sales of machinery, equipment, or transmission lines used to produce or transmit electricity are exempt from transaction privilege tax. In addition, Arizona incentivized solar contractors from 1997 to 2016 by allowing them to deduct income from their tax base for installation of solar generating and transmitting equipment. However, renewable energy facility development generated some

[5] A full-time equivalent worker is defined as one person working full time for one year.

[6] Earnings represent employee compensation that directly benefits the local economy including wages and salaries and a portion of employee benefits. This includes items such as paid leave, supplemental pay, and a portion of insurance benefits. Employee benefits excluded from the direct benefit are Social Security, Medicare, unemployment insurance, and retirement, among other things.

transaction privilege tax for materials and installation income related to foundations and structures. Based on Arizona's transaction privilege tax and use tax rate of 5.6 percent, estimated installation costs for contractors, and purchases of materials for foundations and structures, the direct fiscal benefit to Arizona for rural renewable energy projects was an estimated $16.7 million from 2001 to 2017 (Table 3).

- In total, the direct economic and fiscal benefits of construction and investment in rural renewable energy projects in Arizona from 2001 to 2017 was an estimated $4.6 billion (Table 3).

Table 3: Direct Economic Benefit of Rural Renewable Energy Facility Investments in Arizona, 2001 to 2017

	Estimated Arizona
Direct Economic Benefits ($ in millions)	
Major Equipment	$348.3
Construction Materials	$1,028.5
Design, Engineering, Planning, Other Costs	$2,599.4
Wages and Salaries	$541.5
Employee Benefits*	$83.6
Total Construction Benefits	**$4,601.3**
Construction Employees (FTE)	8,335
Direct Fiscal Benefits ($ in millions)	
Transaction Privilege and Use Tax	$16.7
Total Economic and Fiscal Benefits	**$4,618.0**

**Direct benefit estimated for Arizona includes adjustment for the percent of employee benefits likely spent locally.*

Direct, Indirect, and Induced Economic Benefits

- Based on the industry relationships revealed through the RIMS II multipliers for the construction and manufacturing industries in Arizona, $4.6 billion of direct spending in the state supported an estimated $4.7 billion in additional output in all industries throughout Arizona. This includes the value of the local spending by the construction and manufacturing workers (the induced impact) and of the local supplier companies and their employees (the indirect impact) (Table 4).
- The production of the $4.7 billion in additional output in all industries throughout Arizona required an estimated 8,917 workers, referred to as the indirect workers. These workers had estimated earnings of about $477 million (the indirect earnings) (Table 4).
- Therefore, the total direct and indirect benefits of the rural renewable energy development activity in Arizona was an estimated $9.4 billion in total output ($4.6 billion direct output + $4.7 billion indirect and induced output) produced by 17,971 employees (9,054 direct employees + 8,917 indirect employees) earning a total of about $1.2 billion ($717.2 million direct earnings + $477 million indirect earnings) from 2001 to 2017 (Table 4).
- Construction benefits are temporary, occurring only during construction. The analysis does not indicate whether the direct and indirect employees were residents of Arizona or whether they were nonresidents that commuted into the state.

Table 4: Total Economic Benefit of Rural Renewable Energy Facility Investments in Arizona, 2001 to 2017

	Direct Impact	Multiplier	Indirect & Induced Impact	Total Impact
Construction Activity				
Value of Output ($M)	$4,269.7	2.0490	$4,478.9	$8,748.6
Earnings ($M)	$625.1	1.6382	$398.9	$1,024.0
Employment	8,335	1.8359	6,967	15,302
Manufacturing				
Value of Output ($M)	$348.3	1.7311	$254.7	$603.0
Earnings ($M)	$92.1	1.8480	$78.1	$170.2
Employment	719	3.7109	1,950	2,669
Total Economic Benefit				
Value of Output ($M)	$4,618.0		$4,733.6	$9,351.6
Earnings ($M)	$717.2		$477.0	$1,194.2
Employment	9,054		8,917	17,971

Source: Development Research Partners, based on multipliers for Arizona from the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Input-Output Modeling System (RIMS II), 2007 U.S. Benchmark I-O Data and 2016 Regional Data.

Calculation Note: Direct x Multiplier = Total Impact

Total Impact - Direct Impact = Indirect & Induced Impact

Numbers may not add exactly due to rounding.

ANNUAL OPERATIONS, 2018

The economic and fiscal benefits of the renewable energy operations are derived from sales of energy, which in turn funds business purchases such as equipment, parts, operational materials, leases, taxes, and labor. Some of the renewable energy projects in rural areas of the state transmit and sell energy outside of the state. For example, the 347.7 MW Agua Caliente solar project in Yuma County transmits electricity to California. These projects support local jobs with dollars coming from outside of Arizona. The on-going annual operations of renewable energy facilities in rural Arizona benefit the state through employment, maintenance purchases, and other operating costs.

Direct Economic and Fiscal Benefits

- Based on estimates derived from the JEDI models and current levelized costs, annual purchases of materials and equipment for the state's rural renewable energy facilities will be an estimated $15.4 million in 2018 (Table 5).
- Many renewable energy projects lease land from governments and private landowners. In some cases, renewable projects in Arizona have been located on land already owned by a utility. For instance, the Red Rock Solar Plant built in rural Maricopa County was built on land owned by APS near the Saguaro Natural Gas Power Plant. Based on estimates from the JEDI models, lease payments for rural wind facilities will be an estimated $808,000 in 2018. Comparable information for the state's solar facilities is not available (Table 5).
- Other costs associated with operations and maintenance of the state's rural renewable energy facilities will be an estimated $3.7 million in 2018 (Table 5).

Table 5: Direct Economic and Fiscal Benefit of Annual Operations of Rural Renewable Energy Facilities in Arizona, 2018

	Estimated Arizona
Direct Economic Benefits ($ in millions)	
Materials and Equipment	$15.4
Landowner Payments	$0.8
Other Costs	$3.7
Wages and Salaries	$13.1
Employee Benefits	$5.6
Total Operations Benefits	**$38.6**
Employees (FTE)	234
Direct Fiscal Benefits ($ in millions)	
Property Tax	$0.9
Total Economic and Fiscal Benefits	**$39.5**

- Renewable energy facilities provide on-going employment in Arizona. In 2018, an estimated 234 full-time equivalent employees will be employed at Arizona's rural renewable energy facilities. Compensation for these employees will be an estimated $18.7 million in wages and employee benefits. Compensation includes wages and salaries, employee benefits that contribute to worker earnings such as supplemental pay, and employee benefits that have minimal local impact such as retirement contributions (Table 5).
- Income derived from sales of machinery, equipment, or transmission lines used to produce or transmit electricity are exempt from transaction privilege tax.
- Renewable energy facilities generate property tax revenue for state schools and districts. Renewable energy equipment in Arizona is valued at 20 percent of its original cost after taking into account depreciation and taxable value. The taxable value subtracts out the value of grants or federal renewable investment tax credits from the original cost. The result is considered the full cash value of the equipment. Further, property taxes for various districts and purposes in Arizona are imposed on two separate value calculations, one for limited primary value and one for full cash value. This analysis assumes that full cash value and limited primary value for the project are equal. Based on the estimated full cash value of renewable energy equipment, the assessment rate of 18 percent, and the state education equalization tax rate of $0.4741 per $100 of assessed valuation, schools in Arizona will benefit from $882,000 in property tax revenue in 2018 (Table 5).
- In total, the direct economic and fiscal benefits of annual operations for rural renewable energy projects in Arizona in 2018 will be an estimated $39.5 million (Table 5).

Direct, Indirect, and Induced Economic Benefits

- Based on the industry relationships revealed through the RIMS II multipliers for industries impacted by the business spending in Arizona, $39.5 million of direct output will likely support an estimated $23.8 million in additional output in all industries throughout Arizona in 2018. This includes the value of the local spending by the employees (the induced impact) and of the local supplier companies and their employees (the indirect impact) (Table 6).
- The production of the $23.8 million in additional output in all industries throughout Arizona will require an estimated 468 workers, referred to as the indirect workers. These workers will have estimated earnings of about $18.4 million (the indirect earnings) (Table 6).

- Therefore, the total direct and indirect benefits of annual rural renewable energy operations in Arizona will be an estimated $63.3 million in total output ($39.5 million direct output + $23.8 million indirect and induced output) produced by 702 employees (234 direct employees + 468 indirect employees) earning a total of about $33.5 million ($15.1 million direct earnings + $18.4 million indirect earnings) in 2018 (Table 6).
- These benefits are likely to occur annually assuming similar business conditions and project parameters.

Table 6: Total Economic Benefit of Annual Operations of Rural Renewable Energy Facilities in Arizona, 2018

	Direct Impact	Multiplier	Indirect & Induced Impact	Total Impact
Operations and Maintenance				
Value of Output ($M)	$39.5	1.6019	$23.8	$63.3
Earnings ($M)*	$15.1	2.2211	$18.4	$33.5
Employment	234	3.0010	468	702

**Direct earnings estimate includes adjustment for the percent of employee benefits likely spent locally.*

Source: Development Research Partners, based on multipliers for Arizona from the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Input-Output Modeling System (RIMS II), 2007 U.S. Benchmark I-O Data and 2016 Regional Data.

Calculation Note: Direct x Multiplier = Total Impact

Total Impact - Direct Impact = Indirect & Induced Impact

Numbers may not add exactly due to rounding.

CASE STUDY: POTENTIAL BENEFITS OF NEW PV + STORAGE

Yuma County is a prime location for solar resources and home to four utility-scale facilities with a combined nameplate capacity of 418.7 MW. Notably, the Agua Caliente solar facility, the largest renewable facility in the state, is located in Yuma County. This case study estimates the potential benefits that could be realized if a 100 MW-solar photovoltaic (PV) energy project with 30 MW of battery storage were developed in Yuma County. Communities and areas with similar industries, workforces, and tax structures could realize similar benefits from the development of a new solar PV facility with storage.

Battery storage systems are becoming increasingly viable for renewable energy projects due to declining costs. Lazard's Levelized Cost of Storage[7] analysis projected that the levelized cost of lithium-ion systems used for peak placement at utility-scale facilities could decline by around 15 percent from 2017 to 2018. Renewable energy generation has been limited by the lack of economical storage options. Solar facilities produce the most power during the middle of the day when the sun is high. However, the electricity generated at the facility dips when consumption peaks later in the day. Economical storage options increase the reliability of the renewable energy system.

A significant portion of the investment associated with construction of new renewable energy facilities can benefit local workers and businesses. A new 100 MW-solar PV project with 30 MW of battery storage could cost an estimated $312 million, based on estimates derived from the JEDI model, adjusting for cost reductions, and published estimates of potential lithium-ion battery storage system costs. The storage capability for a system like this would be long-duration, with an estimated 120 MWh of energy, enough for four hours of use.

Table 7: Potential 100 MW-Solar PV with 30 MW-Storage Facility Construction Activity in Yuma County

	Total
Construction Activity ($ in millions)	
Major Equipment	$128.6
Construction Materials	$32.8
Design, Engineering, Planning, Other Costs	$118.4
Wages and Salaries	$22.5
Employee Benefits	$9.7
Total	**$312.0**
Construction Employees (FTE)	389

CONSTRUCTION AND INVESTMENT ACTIVITY

Direct Economic and Fiscal Benefits

- An estimated $128.6 million could be spent on purchases of major equipment such as solar PV modules and batteries (Table 7). These purchases are expected to occur outside of the county, with no direct economic benefit for county-based businesses (Table 8).
- While the purchases of the plant equipment will likely be outside the county, the county could benefit from construction materials purchases. The county could capture a portion of the design, planning, and other costs. Based on the concentration of establishments, employees, and sales in Yuma County and estimated purchases

[7] Reference Lazard's Levelized Cost of Storage Analysis – Version 3.0. https://www.lazard.com/media/450338/lazard-levelized-cost-of-storage-version-30.pdf.

captured in the state from the JEDI model, the direct economic benefit of local purchases of construction materials, design, engineering, planning, and other costs could be an estimated $3.6 million (Table 8).

- An estimated 389 FTE construction workers earning $32.2 million in wages and employee benefits could be employed during the development of a potential solar PV and battery storage facility (Table 7). Based on estimates of local labor, the direct economic benefit to Yuma County could be an estimated $798,400 in earnings for 12 local workers (Table 8).
- Purchases of materials in Yuma County for constructing a solar PV and battery storage facility could generate transaction privilege tax revenue for the county. In addition, installation income for any county-based contractors for the facility will also generate transaction privilege tax. While machines and equipment for producing and transmitting electricity are exempt, it should be noted that equipment for the battery system will be taxable for the facility and will generate state tax revenue. Counties in Arizona do not impose use tax. Based on estimated purchases for the facilities, installation costs, and the county's 1.112% transaction privilege tax rate, the direct fiscal benefit to Yuma County could be an estimated $11,500 (Table 8).
- In total, the direct economic benefit to Yuma County of construction and investment associated with a 100 MW-solar PV energy facility with 30 MW of battery storage could be an estimated $4.4 million (Table 8).

Table 8: Direct Economic Benefits of 100 MW-Solar PV with 30 MW-Storage Facility Investment in Yuma County

	Estimated Yuma County
Direct Economic Benefits	
Major Equipment	$0
Construction Materials	$595,600
Design, Engineering, Planning, Other Costs	$3,031,300
Wages and Salaries	$691,700
Employee Benefits*	$106,700
Total Construction Benefits	**$4,425,300**
Construction Employees (FTE)	12
Direct Fiscal Benefits	
Transaction Privilege Tax	$11,500
Total Economic and Fiscal Benefits	**$4,436,800**

**Direct benefit estimated for Yuma County includes adjustment for the percent of employee benefits likely spent locally.*

Direct, Indirect, and Induced Economic Benefits

- Based on the industry relationships revealed through the RIMS II multipliers for the construction industry in Yuma County, $4.4 million of direct construction spending in Yuma County will likely support an estimated $4.7 million in additional output in all industries throughout the county. This includes the value of the local spending by the construction workers (the induced impact) and of the local supplier companies and their employees (the indirect impact) (Table 9).
- The production of the $4.7 million in additional output in all industries throughout Yuma County will require an estimated 10 workers, referred to as the indirect workers. These workers will have estimated earnings of about $510,000 (the indirect earnings) (Table 9).

Table 9: Total Economic Benefit of 100 MW-Solar PV with 30 MW-Storage Facility in Yuma County

	Direct Impact	Multiplier	Indirect & Induced Impact	Total Impact
Construction Activity				
Value of Output ($M)	$4.4	2.0490	$4.7	$9.1
Earnings ($M)	$0.8	1.6382	$0.5	$1.3
Employment	12	1.8359	10	22

Source: Development Research Partners, based on multipliers for Yuma County, AZ from the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Input-Output Modeling System (RIMS II), 2007 U.S. Benchmark I-O Data and 2016 Regional Data.
Calculation Note: Direct x Multiplier = Total Impact
Total Impact - Direct Impact = Indirect & Induced Impact
Numbers may not add exactly due to rounding.

- Therefore, the total direct and indirect benefits of construction activity associated with a 100 MW-solar PV energy facility with 30 MW of battery storage in Yuma County could be an estimated $9.1 million in total output ($4.4 million direct output + $4.7 million indirect and induced output) produced by 22 employees (12 direct employees + 10 indirect employees) earning a total of about $1.3 million ($798,400 direct earnings + $510,000 indirect earnings) during the construction period (Table 9).
- Construction benefits are temporary, occurring only during construction. The analysis does not indicate whether the direct and indirect employees were residents of Yuma County or whether they were nonresidents that commuted into the area.

ON-GOING ANNUAL OPERATIONS

Direct Economic and Fiscal Benefits

- Based on estimates derived from the JEDI model and adjusting for cost reductions, annual purchases of materials and equipment for a 100 MW-solar PV energy facility with battery storage could be an estimated $855,200 (Table 10).
- Land for large renewable energy facilities is often leased from public or private landowners. It is likely that land for a 100 MW-solar PV and battery storage facility would be leased. However, the cost of leasing will depend on location, market conditions, public or private ownership, and other factors that are not estimated in this analysis.
- A new 100 MW-solar PV energy facility with 30 MW of battery storage will support on-going employment in Yuma County. Based on estimates from the JEDI model, published estimates of potential lithium-ion battery storage system costs, and adjusting for cost reductions, the facility could employ nine workers. Compensation for these employees will be an estimated $853,000 in wages and employee benefits (Table 10).

Table 10: Direct Economic and Fiscal Benefit of Annual Operations of a 100 MW-Solar PV with 30 MW-Storage Facility in Yuma County

	Estimated Yuma County
Direct Economic Benefits	
Materials and Equipment	$855,200
Wages and Salaries	$597,100
Employee Benefits	$255,900
Total Operations Benefits	**$1,708,200**
Employees (FTE)	9
Direct Fiscal Benefits	
Property Tax*	$165,700
Total Economic and Fiscal Benefits	**$1,873,900**

**Represents average over first 10 years of operations based on depreciation.*

- A new 100 MW-solar PV energy facility with 30 MW of battery storage will generate property tax revenue for the county. Based on the estimated value of the facility, depreciation for the property averaged over the first 10 years of operations, and the county tax rate of $2.5288 per $100 of assessed valuation, the county will benefit from $165,700 in annual property tax revenue (Table 10).

  A new facility will also benefit local schools and other property tax districts in the county. Based on the average primary tax rate in the county and subtracting the county rate and school equalization rate, primary districts including schools and cities in the county will benefit from an estimated $505,800 in annual property tax revenue. Based on the average secondary rate in the county, districts such as libraries, community colleges, and flood control, in addition to schools and cities with approved secondary rates, will benefit from $171,700 in annual property tax revenue.

- Purchases of materials and equipment from vendors operating in Yuma County will generate transaction privilege tax revenue for the county. However, the annual materials and equipment purchases are assumed to occur outside of the county and are not expected to generate transaction privilege tax revenue for the county.

- In total, the direct economic and fiscal benefits of annual operations for a 100 MW-solar PV energy facility with 30 MW of battery storage in Yuma County could be an estimated $1.9 million (Table 10).

Direct, Indirect, and Induced Economic Benefits

- Based on the industry relationships revealed through the RIMS II multipliers for industries that will be impacted by the potential business spending in Yuma County, $1.9 million of direct output will likely support an estimated $1.1 million in additional output in all industries throughout Yuma County. This includes the value of the local spending by the employees (the induced impact) and of the local supplier companies and their employees (the indirect impact) (Table 11).

- The production of the $1.1 million in additional output in all industries throughout Yuma County will require an estimated 21 workers, referred to as the indirect workers. These workers will have estimated earnings of about $842,000 (the indirect earnings) (Table 11).

- Therefore, the total direct and indirect benefits of annual operations for a new 100 MW-solar PV energy facility with 30 MW of battery storage in Yuma County could be an estimated $3 million in total output ($1.9 million direct output + $1.1 million indirect and induced output) produced by 30 employees (9 direct

employees + 21 indirect employees) earning a total of about $1.5 million ($689,000 direct earnings + $842,000 indirect earnings) (Table 11).

- These benefits are likely to occur annually assuming similar business conditions and project parameters.

Table 11: Total Economic Benefit of Annual Operations of a 100 MW-Solar PV with 30 MW-Storage Facility in Yuma County

	Direct Impact	Multiplier	Indirect & Induced Impact	Total Impact
Operations and Maintenance				
Value of Output ($M)	$1.9	1.6019	$1.1	$3.0
Earnings ($M)*	$0.7	2.2211	$0.8	$1.5
Employment	9	3.3704	21	30

**Direct earnings estimate includes adjustment for the percent of employee benefits likely spent locally.*

Source: Development Research Partners, based on multipliers for Yuma County, AZ from the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Input-Output Modeling System (RIMS II), 2007 U.S. Benchmark I-O Data and 2016 Regional Data.

Calculation Note: Direct x Multiplier = Total Impact

Total Impact - Direct Impact = Indirect & Induced Impact

Numbers may not add exactly due to rounding.

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